ORIGINAL ARTICLE

Predictors of Success at 6-Month Follow up for Smokers Treated at a Smoking Cessation Clinic

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OBJECTIVE: To identify the predictors of successful outcome in a smoking cessation program at 6-month follow up.

MATERIAL AND METHODS: Cross-sectional descriptive study of a sample of smokers who attended a smoking cessation clinic for combined medical and cognitive-behavioral group therapy. The independent variables assessed included age, sex, level of education, nicotine dependence (Fagerström test), prior attempts to quit smoking, medication prescribed, compliance with group therapy regimen, and success at week and 3 months. Success was defined as self-reported abstinence, confirmed by CO-oximetry (carbon monoxide <10 ppm). Odds ratios (with 95% confidence intervals) were calculated for the categorical variables and a test of statistical significance of differences between means was performed for quantitative variables. Univariate logistic regression analysis was performed and significant variables were entered into a multivariate logistic regression model.

RESULTS: The study population comprised 248 individuals, 67.7% male and 32.3% female, with a mean (SD) age of 43.1 (10.5) years. The mean score on the Fagerström test was 6.3 (2.1) points and 84.7% of the individuals complied with the treatment regimen. Success rates were as follows: 77% at week, 30.2% at 3 months, and 31.9% at 6 months. Three variables—success at 3 months, age, and nicotine dependence—were entered into the multivariate logistic regression model; the only variable predictive of successful smoking cessation at 6 months was success at 3 months.

CONCLUSIONS: Individuals who fully comply with treatment and abstain from smoking during the first weeks are more likely to be successful at 6 months.

Key words: *Tobacco addiction. Predictors of success. Smoking cessation.*

Factores predictores de éxito a los 6 meses en fumadores tratados en una unidad de tabaquismo

OBJETIVO: Analizar los factores predictores del éxito de un programa de deshabituación tabáquica a los 6 meses de seguimiento.

MATERIAL Y MÉTODOS: Se ha realizado un estudio analítico transversal en una muestra formada por fumadores que habían accedido a una unidad de tabaquismo para tratamiento multi-componente en grupo. Las variables independientes analizadas fueron: edad, sexo, nivel de estudios, dependencia la nicotina (test de Fagerström), intentos previos, fármaco prescrito, cumplimentación del tratamiento grupal, éxito a la semana y a los 3 meses. Se consideró éxito la abstinencia autodeclarada y confirmada mediante cooximetría (monóxido de carbono < 10 ppm).

Se aplicó un análisis de regresión logística univariante, determinando las *odds ratios* con los intervalos de confianza del 95% para las variables categóricas, y el test de diferencia de medias para las variables cuantitativas; aquellas que mostraron significación estadística se introdujeron en un modelo de regresión logística multivariante.

RESULTADOS: La población de estudio estaba compuesta por 248 individuos, el 67,7% varones y el 32,3% mujeres, con un media (± desviación estándar) de edad de 43,1 ± 10,5 años. En cuanto a la dependencia de la nicotina, la puntuación media en el test de Fagerström era de 6,3 ± 2,1 puntos, y el 84,7% de los individuos cumplió bien el tratamiento. Las tasas de éxito fueron del 77, el 30,2 y el 31,9% a la semana y a los 3 y 6 meses, respectivamente. Las variables: éxito a los 3 meses, edad y dependencia de la nicotina se introdujeron en el modelo de regresión logística multivariante, y la única variable predictora de éxito a los seis meses fue la primera.

CONCLUSIONES: Los individuos que cumplen bien el tratamiento y no fuman nada durante las primeras semanas tienen más probabilidades de lograr el éxito a los 6 meses.

Palabras clave: *Tabaquismo. Predictores de éxito. Deshabituación tabáquica.*

Introduction

Two main approaches to tobacco addiction have been used in Spain: primary prevention to limit the number of new smokers and secondary prevention to increase the number of ex-smokers.[1]

Seventy percent of smokers want to quit, but most find it very difficult to do so without assistance.[2] Smokers currently have many resources available for help in quitting. In order to increase the number of ex-smokers, several organizations have agreed on common treatment guidelines for use at primary care centers and specialized treatment units.[3] Nicotine replacement therapy (NRT) and bupropion have proven to be effective in treating tobacco addiction at all levels of care.[4] However, the abstinence rate achieved is unsatisfactory.

A number of studies have been carried out to identify ways to improve treatment protocols to increase abstinence rates.[5] Some authors agree that successful smoking cessation therapy is correlated with the smoker's stage of readiness in the change process as well as degree of motivation prior to treatment.[6-9] To date, no pre-treatment factor has been identified that is able to successfully predict medium- and long-term abstention. Only abstinence at 1 week of treatment has proven to predict success at 1 year.[10,11]

The main objective of this study was to identify the factors likely to lead to a successful outcome for patients treated in a smoking cessation program, with the aim of increasing medium- to long-term abstinence rates through the efficient use of resources.

Material and Methods

A cross-sectional descriptive study was performed. The subjects were smokers aged 18 and over who underwent smoking cessation therapy at the Smoking Cessation Clinic at the University of Zaragoza's Medical School during the years 2002 and 2003. The clinic provides free treatment to all smokers who request it or who are referred by a doctor. Patients come from a general urban population and may be referred by the doctor at their place of work, by their family physician at their primary health care center, or they may enroll on their own initiative. In all cases, it is the smoker him- or herself who enrolls by telephone. As described elsewhere, patients with acute psychiatric illness or active drug addiction were excluded from the study.[12]

Treatment consisted of combined medical and cognitive-behavioral group therapy. The smoking history of each patient was recorded prior to treatment. Medical treatment consisted of NRT or bupropion, depending on the patient's prior medical history, degree of nicotine dependence, and preferences. Cognitive-behavioral therapy involved 9 group sessions over 3 months. These sessions included coping strategies, behavioral rehearsal, relapse prevention, benefits of quitting, and weight control.[13] Abstinence was determined at each session, with self-reported abstinence confirmed by carbon monoxide (CO)-oximetry (CO≤10 ppm) using a Mini Smokerlyzer (Bedfont Scientific Ltd, Rochester, England).[14]

Patients were contacted by telephone at 6 months for a status check (smoker or not). Those who reported continued abstinence were scheduled, as a group, for CO-oximetry.

The following independent variables were evaluated as possible predictors of success at 6 months: age, sex, level of education (classified as elementary or secondary-university), physical dependence as measured by a modified Fagerström

test, prior attempts to quit smoking, medication prescribed (NRT or bupropion), compliance with the group therapy regimen (considered "good" for patients who attended 4 or more consecutive sessions, otherwise considered "poor"), success at 1 week, and success at 3 months.[15]

Statistical Analysis

Data management and statistical analysis were performed with a database created with the SPSS 11.0 statistical software package for Windows.

A descriptive analysis was performed. Categorical variables were expressed as proportions and absolute frequency distributions; means and standard deviations were calculated for the quantitative variables. The odds ratio (with 95% confidence intervals) was then calculated for each independent categorical variable. A test of statistical significance was performed for quantitative variables. Univariate logistic regression analysis was performed to assess the relation between each variable and abstinence at 6 months. Significant variables, as determined by the univariate analysis, were then entered into a multivariate logistic regression model.

Results

The sample comprised 273 patients interviewed in person. Of these, 9.2% (n=25) failed to attend group therapy sessions and were therefore omitted from the study.

Of the 248 individuals who began group treatment, 67.7% (n=168) were male and 32.3% (n=80) female, with a mean (SD) age of 43.1 (10.5) years. In terms of educational level, 23.4% (n=58) had completed elementary studies and 76.6% (n=190) had completed secondary or university studies. With regard to prior attempts to quit smoking, 21.8% (n=54) of the patients had never attempted to quit, while 78.2% (n=194) had made 1 or more attempts. The mean score on the modified Fagerström test was 6.3 (2.1) points. NRT was given to 66.5% (n=165) of the patients, and 33.5% (n=83) received bupropion. Compliance with the treatment regimen was considered good for 84.7% (n=210) of the patients and poor for 15.3% (n=38), who attended fewer than 4 group sessions (Tables 1 and 2).

Of the patients included in the study, 77% (n=191) continued to abstain from smoking at 1 week, 30.2% (n=75) at 3 months, and 31.9% (n=79) at 6 months (Table 3). More ex-smokers were counted at 6 months than at 3 months because success (determined by self-reporting and CO-oximetry) could not be assessed at 3

TABLE 1
Distribution by Age and Fagerström Test Score*

	Age, Years	Fagerström Test
Total	43.1 (10.5)	6.3 (2.1)
Males	43.8 (10.7)	6.5 (2.1)
Females	41.8 (10.0)	5.5 (1.9)

*Data given as means with the SD between parentheses. No significant differences between sexes were found.

TABLE 2
Distribution of the Sample by Categorical Variables

Variable	Number of Patients (%)
Sex	
Male	168 (67.7)
Female	80 (32.3)
Level of education	
Elementary	58 (23.4)
Secondary-university	190 (76.6)
Prior attempts to quit	
Yes	194 (78.2)
No	54 (21.8)
Pharmacological therapy	
Nicotine replacement therapy	165 (66.5)
Bupropion	83 (33.5)
Compliance	
Good	210 (84.7)
Poor	38 (15.3)

TABLE 3
**Success as Measured by Self-Reported Abstinence
and CO-Oximetry (CO≤10 ppm)***

	Number of Patients (%)
Success at 1 week	
Yes	191 (77)
No	57 (23)
Success at 3 months	
Yes	75 (30.2)
No	173 (69.8)
Success at 6 months	
Yes	79 (31.9)
No	169 (68.1)

*CO indicates carbon monoxide.

TABLE 4
**Factors Predictive of Smoking Cessation at 6 Months:
Categorical Variables***

	OR (95% CI)	P
Sex (male compared to female)	1.1 (0.6-2.1)	.665
Level of education (elementary compared to secondary-university)	1.3 (0.7-2.5)	.416
Prior attempts to quit (yes compared to no)	0.7 (0.3-1.3)	.210
Pharmacological treatment (NRT compared to bupropion)	1.2 (0.7-2.3)	.481
Compliance (yes compared to no)	Undefined†	<.00001
Success at 1 week (yes compared to no)	3.6 (1.5-8.8)	.001
Success at 3 months (yes compared to no)	5.1 (2.7-9.6)	<.00001

*CI indicates confidence interval; OR, odds ratio; NRT, Nicotine Replacement Therapy.
†The OR could not be calculated because no patient who failed to comply with the treatment regimen was successful at 6 months.

TABLE 5
**Factors Predictive of Smoking Cessation at 6 Months:
Quantitative Variables***

	Differences Between Means (95% CI)	P
Age, years	−2.7 (−5.6 to 0.1)	.056
Fagerström test	0.5 (−0.0 to 1.1)	.065

*CI indicates confidence interval.

months because some patients failed to attend that follow-up visit but did attend the 6-month one.

Univariate logistic regression analysis showed that the following independent categorical variables were not predictive of success at 6 months: sex, level of education, prior attempts to quit smoking, and type of medication. The only variables that correlated very significantly with success at 6 months were the following: success at 1 week, success at 3 months, and compliance with group therapy (Table 4). However, given the strong linear relation between these variables, only the variable with the highest odds ratio (success at 3 months) was included in the multivariate analysis. It should be noted that the odds ratio for compliance could not be calculated because no patient with poor compliance was successful at 6 months.

Tests for differences between means were applied to the quantitative variables (age and Fagerström test score) in relation to success at 6 months. The *P* values so obtained were only slightly greater than .05 (Table 5) and, consequently, these variables were also entered into the multivariate logistic regression model.

For the reasons described above, the following variables were considered to be potential predictors of success and were finally included in the multivariate logistic regression model: success at 3 months, age, and Fagerström test score. Results from the multivariate model showed that success at 3 months—which had given clear indications of having predictive value—was the only variable predictive of successful outcome at 6 months.

Discussion

The success rate in our study at 6 months—31.9%—is similar to rates reported by other authors even though methods used to measure abstinence vary from study to study.[16] Several authors have evaluated the potential disparity between self-reported results and those obtained by objective measures of the CO level. Results have varied depending on the study population. For example, when assessing the presence or not of tobacco use in epidemiological studies of adolescents, a notable difference exists between the two measures.[17] This difference is also found in respiratory patients who smoke.[18] For smokers who have undergone smoking cessation treatment the difference may be smaller.[19,20] In our study, the criteria used to determine success were self-reporting and CO-oximetry of ≤10 ppm. When we compared the self-reported success rate to the success rate confirmed by CO-oximetry (Table 6), the rates changed from 68.1% to 31.9%. Recently, the difference between the 2 measures in smokers undergoing treatment has been estimated to be 2%, and this has led us to believe our results may have understated the actual success rate.[21] A meta-analysis of the validity of self-reporting recommends the use of biochemical validation in interventional studies.[17] However, self-reporting has been described as a useful tool that is less

TABLE 6
**Differences Between Self-Reported Success
and Self-Reported Success With CO-Oximetry
(CO≤10 ppm)***

	Number of Patients (%)
Success at 1 week	
Self-reported	
Yes	219 (88.3)
No	29 (11.7)
Self-reported + CO-oximetry	
Yes	191 (77)
No	57 (23)
Success at 3 months	
Self-reported	
Yes	193 (77.8)
No	55 (22.2)
Self-reported + CO-oximetry	
Yes	75 (30.2)
No	173 (69.8)
Success at 6 months	
Self-reported	
Yes	156 (62.9)
No	92 (37.1)
Self-Reported + CO-oximetry	
Yes	79 (31.9)
No	169 (68.1)

*CO indicates carbon monoxide.

expensive and more accessible than biochemical validation, which, in addition to being expensive, requires that all patients in a study be tested. That condition is sometimes difficult to achieve, as we found in our study.[16] Performing tests during group sessions is not ideal because scheduling conflicts—which occur because the times and dates are set for the whole group—limit attendance, even for patients who continue to abstain from smoking. For this reason, individualized follow up should be considered in future studies to maximize overall participation rates. Although group therapy is effective for learning behavioral patterns and for mutual support, this reinforcement and resource sharing makes less sense during follow up.[22,23]

In any case, these evaluation criteria (self-reporting and CO-oximetry) were an important methodological component of the study design because some interventional studies lack an appropriate description of the successful outcome variable, thus making interpretation of the results more difficult.

We found—as other studies have reported previously—that neither the sociodemographic variables assessed nor those related to tobacco use were good indicators of success at 6 months.[5] Only the combination of abstinence in the short or medium term and compliance with therapy showed a significant relation to a successful outcome. The value of behavioral therapy—the essence of group sessions—is supported by the fact that patients who attend the sessions are likely to have a greater probability of success. Statistical analysis revealed that success at 1

week and success at 3 months were closely related to compliance; therefore, compliance may be considered a good substitute for the other 2 variables. Compliance has, moreover, an additional advantage: it is easy to evaluate and does not depend on subjective judgments from either the patient or the therapist. Age and physical dependence on nicotine have been described in several studies as predictors of medium to long term success.[24-26] However, the population sample in our study was relatively homogenous with respect to these 2 variables; for this reason, together with the strong influence of success in the first weeks, the effect of these variables may have been minimized to such a degree that they were found to be insignificant when entered into the multivariate regression analysis model.

Both NRT and bupropion have proven to be effective in treating tobacco addiction. The choice of medication depends on each smoker's individual characteristics and, to date, no clear criteria have been established for deciding when to use one or the other. Neither the type of medication nor prior attempts to quit smoking were predictive of success at 6 months. However, we believe that prior attempts to quit may be predictive of successful outcome on an individual basis—that is, a subject's prognosis is better when compared to a previous attempt to quit, even though the probability of success is no greater when compared to individuals making their first attempt. It seems likely that the need to make multiple attempts to quit smoking reflects the presence of other, poorly-understood factors unique to each individual that make sustained abstinence difficult.

The smoker's stage in the change process is another variable that has been studied by several authors; the contemplation and action stages are considered to be better predictors of successful outcome.[2,16,24] We did not evaluate these variables because all of the participants in our study were motivated smokers in the preparation stage rather than an earlier one.

Most studies that have assessed the potential predictive value of variables related to tobacco use (physical dependence), individual factors (readiness to change), or demographics (age, sex) have been carried out on dissimilar populations using widely varying methods. Examples of these studies include those that have evaluated behavioral therapy alone, noninterventional epidemiological studies of large populations, and studies of primary care treatment with minimal intervention, with or without medication. Together, they have contributed to the current situation: no unanimous agreement exists as to which factors are useful in predicting successful smoking cessation.

In short, we can conclude that individuals who fully comply with treatment and completely avoid smoking during the first weeks of therapy have a higher probability of achieving success with combined medical and behavioral therapy. These findings should be taken into account throughout the smoking cessation process and patients should be informed of these facts to reinforce long term abstinence. Nonetheless, our study

demonstrates the need for prospective studies to more clearly establish the pretreatment profile of smokers likely to quit smoking successfully.

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